Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech**
PEME5401

7th Semester Back Examination 2019-20
MECHANICAL VIBRATION
BRANCH : MECH
Time : 3 Hours
Max Marks : 70
Q.CODE : HB202

Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) How natural frequency of a system affects its performance?
b) What do you mean by damping? What are the various types of damping?
c) What is beat phenomenon? Describe with neat sketch.
d) What is over-damping and under-damping of a system? Explain with graphical representation with applications.
e) What is logarithmic decrement? Explain its importance.
f) A mass of 2 kg is attached to the end of a spring having stiffness 20 N/cm. Determine critical damping co-efficient.
g) What is degree of freedom of a vibrating system? Explain mode of vibration.
h) What do you mean by dynamic coupling and static coupling of a two degree of freedom system?
i) Differentiate between accelerometer and vibrometer.
j) Write down the one dimensional wave equation and explain the terms.

Q2 **a)** A force $F = F_0 \sin \omega t$ acts on a displacement $x = x_0 \sin(\omega t - 30^0)$ where $F_0 = 20$ N, $x_0 = 0.05$ m and $\omega = 20\pi$ radian/sec. **(5)**

What is the workdone during
(i) the first second?
(ii) the first 1/40 second?

b) Find the natural frequency of the system shown in Fig. 1.,Take I_0= Combined moment of inertia of disc about *O*. **(5)**

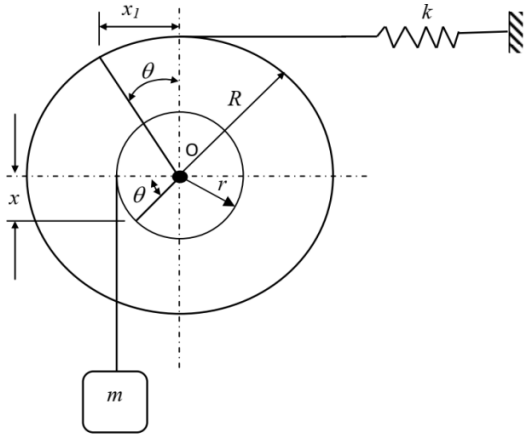

Fig.1

Q3 **a)** In a spring mass system the mass of 10 kg makes 40 oscillations in 20 second without damper. With damper, the amplitude decreases to 0.2 of original value after 5 oscillations. Find out- a) stiffness of spring b) logarithmic decrement c) Damping factor d) Damping coefficient. **(5)**

b) A machine of mass 75 kg is mounted on an isolator having stiffness 1200×10^3 N/m and a damping factor 0.2. A reciprocating part of 2 kg has 80 mm stroke. If the crank speed is 3000 r.p.m., determine-a) the amplitude of machine b) the phase angle c) the force transmitted to the foundation. **(5)**

Q4 **a)** Explain the method to determine the critical speed of shaft carrying single rotor neglecting damping. **(5)**

b) A 100 kg machine is mounted on a table of stiffness 1.5 $x10^5$ N/m. During operation, it is subjected to a harmonic excitation of magnitude 1500 N at 50 rad/s. Find the required stiffness of a 5 kg absorber to eliminate the steady state vibrations of the machine during operation. **(5)**

Q5 **a)** What is semi-definite system? Explain with suitable sketch and compute value of the natural frequencies. **(5)**

b) Determine the stiffness influence coefficients for the three degrees of freedom system shown in the Fig. 2. **(5)**

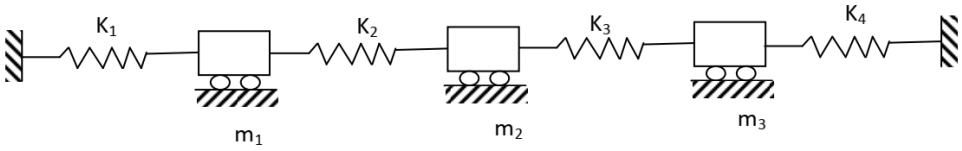

Fig. 2

Q6 Using Holzer method, determine the natural frequencies of the system as shown in Fig.3. Take $k_{ti}=k_{t2}=1$, $I_1=I_2=I_3=1$. **(10)**

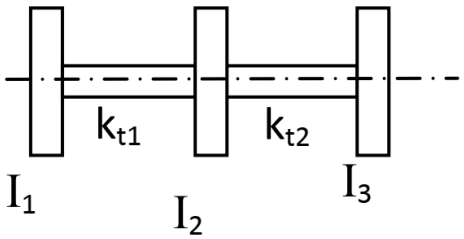

Fig. 3

Q7 Derive the frequency equation and plot the first three Eigen function for the lateral vibration of a string fixed at both ends. **(10)**

Q8 **Write short Notes on any TWO :** **(5 x 2)**

a) Structural damping.

b) Principle of dynamic vibration absorber.

c) One dimensional wave equation.